

AQA 1.7 Extra Questions (answers are at the back)

Q1.(a) Describe how DNA is replicated.

(6)

(b) The graph shows information about the movement of chromatids in a cell that has just started metaphase of mitosis.

(i) What was the duration of metaphase in this cell?

minutes

(1)

(ii) Use line **X** to calculate the duration of anaphase in this cell.

minutes

(1)

(iii) Complete line **Y** on the graph.

(2)

(c) A doctor investigated the number of cells in different stages of the cell cycle in two tissue samples, **C** and **D**. One tissue sample was taken from a cancerous tumour. The other was taken from non-cancerous tissue. The table shows his results.

		Percentage of cells in each stage of the cell cycle	
	Stage of the cell cycle	Tissue sample C	Tissue sample D
	Interphase	82	45
	Prophase	4	16
	Metaphase	5	18
	Anaphase	5	12
	Telophase	4	9

(i) In tissue sample **C**, one cell cycle took 24 hours. Use the data in the table to calculate the time in which these cells were in interphase during one cell cycle. Show your working.

Time cells in interphase hours

(2)

(ii) Explain how the doctor could have recognised which cells were in interphase when looking at the tissue samples.

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(1)

(iii) Which tissue sample, **C** or **D**, was taken from a cancerous tumour?
Use information in the table to explain your answer.

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(2)

(Total 15 marks)

Q2. The diagram shows a cell cycle.

(a) In prophase of mitosis, the chromosomes become visible. Describe what happens in

(i) metaphase

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(2)

(ii) anaphase.

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(2)

- (b) (i) Cells lining the human intestine complete the cell cycle in a short time. Explain the advantage of these cells completing the cell cycle in a short time.

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(1)

- (ii) The time required for a cell to complete the cell cycle was 4 hours 18 minutes.
- Calculate the time required in minutes for this cell to multiply to produce eight cells.
- Show your working.

Answer

(2)

- (c) Mikanolide is a drug that inhibits the enzyme DNA polymerase. Explain why this drug may be effective against some types of cancer.

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(2)
(Total 9 marks)

- Q3.** (a) Boxes **A** to **E** show some of the events of the cell cycle.

1

(i) List these events in the correct order, starting with **D**.

2

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(1)

(2)

(Total 8 marks)

(ii) Name the stage described in box **E**.

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Q4. (a) The drawing shows a stage of mitosis in an animal cell. (1)

(b) (i) Name this stage of mitosis.
Name the phase during which DNA replication occurs.

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(1)

(ii) Describe and explain what happens during this stage which ensures that two genetically identical cells are produced.

(c) Bone marrow cells divide rapidly. As a result of a mutation during DNA replication, a bone marrow cell may become a cancer cell and start to divide in an uncontrolled way. A chemotherapy drug that kills cells when they are dividing was given to a cancer patient. It was given once every three weeks, starting at time 0. The graph shows the changes in the number of healthy bone marrow cells and cancer cells during twelve weeks of treatment:

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(2)

(i) Using the graph calculate the number of cancer cells present at week 12 as a percentage of the original number of cancer cells. Show your working.

(b) The graph shows the relative amounts of DNA per cell during two successive cell divisions in an animal.

Answer%

(i) What stage of the cell cycle is shown by **X**? (2)

(ii) Suggest **one** reason for the lower number of cancer cells compared to healthy cells at the end of the first week.

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(1)

(iii) Describe **two** differences in the effect of the drug on the cancer cells, compared with healthy cells in the following weeks.

(ii) Apart from an increase in the amount of DNA, give **one** process which occurs during

stage **X** which enables nuclear division to occur.

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(1)

- (iii) How many units of DNA would you expect to be present in a gamete formed in this animal as a result of meiosis?

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(1)

- (c) The table shows the average duration of each stage of the cell cycle in the cells of a mammalian embryo.

Stage	Mean duration/ minutes
Interphase	12
Prophase	50
Metaphase	15
Anaphase	10
Telophase	42

Give **one** piece of evidence from the table which indicates that these cells are multiplying rapidly.

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(1)

(Total 7 marks)

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- (1)
- (ii) Suggest an explanation for the change in the chromosome number.
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(1)
(Total 6 marks)

Q5. The diagrams show four stages of mitosis.

- (a) (i) Name stage **A**.
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- (1)

- (ii) Starting with stage **C**, give the stages **A** to **D** in the correct order.

C (1)

- (iii) Describe and explain the appearance of one of the chromosomes in stage **B**.

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(2)

- (b) Colchicine is a substance that prevents the formation of the spindle in mitosis. Dividing cells were treated with colchicine. This stopped them dividing. After a few hours, the colchicine was removed and the cells began to divide again. The diagram shows the chromosomes from one of the treated cells at stage **B** after the cell began dividing again.

- (i) What has happened to the chromosome number?

- M1.(a)** 1. (ii) 1. No visible chromosomes / chromatids;
Strands separate / H-bonds break;
2. Visible nucleus;
1. *Neutral: strands split*
1. *Accept: strands unzip* 1 max
2. DNA helicase (involved);
- (iii) ~~Both strands~~ / each strand act(s) as (a) template(s);
4. (Free) nucleotides attach; interphase / higher % (of cells) in mitosis / named stage of mitosis;
4. *Neutral: bases attach*
1. *Accept: 'less' or 'more' instead of '%'*
4. *Accept: nucleotides attracted*
1. *Do not accept: higher % (of cells) in each / all stage(s)*
5. Complementary / specific base pairing / AT and GC;
2. (So) more cells dividing / cells are dividing quicker;
6. DNA polymerase joins nucleotides to new strand;
2. *Accept: joins nucleotides to new strand*
2. *Reject: if wrong function of DNA polymerase* 2
7. H-bonds reform; [15]
8. Semi-conservative replication / new DNA molecules contain one old strand and one new strand;
8. *Reject: if wrong context e.g. new DNA molecules contain half of each original strand*
- M2.** (a) (i) Spindle formed / chromosome/centromere/chromatids attaches to spindle; 6 max
- (b) (i) Chromosomes/chromatids line up/move to middle/equator (of cell);
~~10~~;
Do not award second mark for answers referring to chromosomes 'pairing up'.
Ignore reference to homologous chromosomes unless context suggests pairing which negates second mark.
Neutral: Details on nuclear membrane. 1
- (ii) 10; *Accept: Diagram for second marking point.* 2 1
- (iii) 1. Horizontal until 18 minutes;
Chromosome/centromere splits / chromatids / 'chromosomes' separate/pulled apart;
Allow +/- one small box
To (opposite) sides/poles/centrioles (of cell);
2. (Then) decreases as straight line to 0 um at 28 minutes;
Reject: Homologous chromosomes separate for first marking point
Do not allow lines that start from the wrong place, ending at 0 at 28 minutes
Accept: Diagram for second marking point.
Chromatids / 'chromosomes' move to poles/sides/centrioles = 2 marks. 2
- (c) (i) Two marks for correct answer of 19.68 or 19.7;;
Accept 19hrs 41mins
- (b) (i) Form/replace cells quickly/rapidly / divide/multiply/replicate rapidly;
One mark for incorrect answers in which candidate clearly multiplies by 0.82;
Neutral: Repair cells.
Allow one mark for incorrect answers that clearly show 82% of 24 (hours) 1 2
- (li) Correct answer = 774 minutes/ 12 hours 54mins = 2 marks;;

	(ii)	ATP production/protein synthesis/cell replication of centrioles;	2	
	(iii)	1.2;	1	
	(c)	Prevents/slows DNA replication/doubling; Short duration of <u>Interphase</u>; Prevents/slows mitosis;	1	[7]
		New strand not formed / nucleotides (of new strand) not joined together / sugar-phosphate bonds not formed; <i>First marking point must be in context of DNA replication not cell replication.</i> <i>Do not negate first marking point if role of DNA polymerase is described incorrectly e.g. Reject: 'joins bases/strands together'.</i> <i>Role of DNA polymerase must be correct for last marking point.</i>		
M5.	(a)	(i) A anaphase;	1	[9]
	(ii)	(C) B,A,D;	1	
M3.	(a)	(iii) (original) chromosome/DNA has been replicated; each chromosome consists of two chromatids/ (i) (D) B-E-A-C chromatids attached at centromere; <i>(accept reference to condensed state of chromosomes)</i>	1	
	(ii)	<u>metaphase</u> ;	2	
	(b)	interphase/S phase;	1	
	(b)	(i) it has doubled/now 8;	1	
	(ii)	chromosome/DNA replication but no separation		
	(c)	(i) anaphase / cell division; 6(%) <i>(correct answer 2 marks)</i>	1	[6]
	(ii)	more(cancer cells) killed, cancer cells divide more (often) (so are more likely to be killed, more susceptible);	2	
	(iii)	longer time to recover; reduced rate of mitosis / divide more slowly/ increased doubling time;	1	
			2	[8]
M4.	(a)	(i) anaphase;	1	
	(ii)	sister / identical <u>chromatids</u> (separate); move to opposite poles / ends / sides;	2	
	(b)	(i) interphase;	1	